

Enabling multi-platform mission planning and operations simulation environments for adaptive remote sensors

Completed Technology Project (2017 - 2019)



Project Introduction

We propose to develop a flexible and modular open source library for designing multi-platform missions with adaptive sensors operating under resource constraints in order to predict the science performance achieved and to refine adaptive methods in the design process. This work represents an important step in promoting the use of adaptive sensors in Earth observing missions. The growing potential of sensors capable of real-time adaptation of their operational parameters calls for a new class of mission planning and simulation tools. Existing simulation tools used in performing observing system simulation experiments (OSSEs) assume a fixed set of sensor parameters in terms of observation geometry, frequencies used, resolution, or observation time, which allows simplifications to be made in the simulation process and allows sensor observation errors to be characterized a-priori. Adaptive sensors may vary all of these parameters depending on the scene observed, so that sensor performance is not simple to model without conducting OSSE simulations including sensor adaptation in response to stochastic variations in the scenes observed. The management of power and data volume resources on small satellite platforms as well as methods to allow collaborative sensing among sensors on multiple platforms are also high current needs for inclusion in mission simulation tools. The library will be developed based on the past experience of the project team with the development of OSSE and mission planning tools for multiple projects. These include the end-to-end-simulator developed for the eight satellite constellation of the CYGNSS program, a simulation tool and onboard processor developed to optimize mission operations for the CubeSat Radiometer Radio Frequency Interference Technology validation experiment, and past experience in the development of a fully adaptive radar system and associated modeling and simulation environment. The library will progress from its current TRL 2 to a TRL 4 exit status through a two year project focused on library development and testing in year one and extensive demonstration through three case studies in year two. The open source modular library will be designed to facilitate its incorporation into a variety of OSSE tools for future missions, particularly those currently under consideration by the Earth Science Decadal Survey.



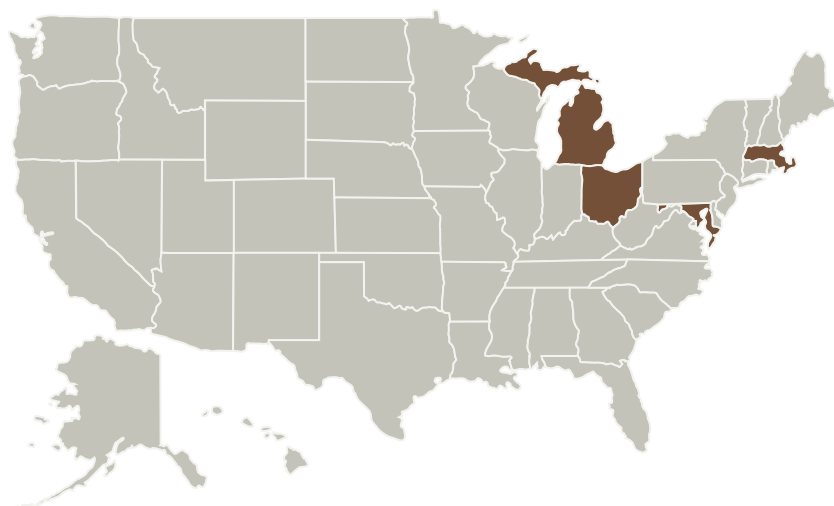
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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Ohio State University-Main Campus	Lead Organization	Academia	Columbus, Ohio

Primary U.S. Work Locations	
Maryland	Massachusetts
Michigan	Ohio

Organizational Responsibility

Responsible Mission Directorate:

Science Mission Directorate (SMD)

Lead Organization:

Ohio State University-Main Campus

Responsible Program:

Advanced Information Systems Technology

Project Management

Program Director:

Pamela S Millar

Program Manager:

Jacqueline J Le Moigne

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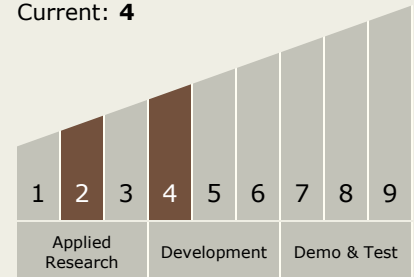
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Technology Maturity (TRL)

Start: 2
Current: 4



Technology Areas

Primary:

- TX11 Software, Modeling, Simulation, and Information Processing
 - └ TX11.5 Mission Architecture, Systems Analysis and Concept Development
 - └ TX11.5.1 Tools and Methodologies for Defining Mission Architectures or Mission Design

Target Destination

Earth